Let's Talk Water – Ground-Water Study Data Collection and Data Management

By Dr. Mike Strobel

Six parts of the BARCASS (Basin and Range Carbonate Aquifer System Study) were mentioned in this column a few weeks ago. These include (1) consolidation of information and operation of a unified data collection network; (2) determination of the extent, thickness and hydrologic properties of the various aquifer units and estimation of the volume of ground water in storage; (3) delineation of ground-water recharge areas and rates; (4) delineation of ground-water discharge areas and rates; (5) correlation and quantification of water budget components into conceptual regional flow systems; and (6) reporting of results.

The first task is an extremely critical part of the study. This involves identifying previous scientific information, such as ground-water levels, spring measurements, and models, and present data collection efforts by various agencies and groups, and organizing this information into a single database.

At first glance, this may not seem like such a difficult task. But the reality is that there are a lot of different kinds of data available and identifying where the information is located, how it was collected, and in what format it is stored is truly a daunting task. Then, once the data are gathered, the information needs to be organized into a single database so that data from various sources and in various formats can be compared and utilized for the study.

For example, let's look at just ground-water levels. The USGS maintains a database of ground water information that contains data for many of the wells in the study area. It is possible that the State has additional wells in their files that may not be in the USGS database, although the USGS and the State are very good about sharing data. Many of the older wells dug or drilled prior to State requirements for filing drillers' logs may be in files in County or local records, if at all, or mentioned in earlier ground-water reports. Maybe other groups, such as SNWA, various irrigation districts, and mining companies, have data on ground-water levels collected for their own purposes and which are not in the USGS database. There are also huge amounts of data collected during test drilling by the oil and gas companies that would be valuable information.

Even once data are identified, bringing the information into a single database is not easy. There are issues with varying degrees of accuracy in collecting the data. For example, some wells are surveyed using methods such as GPS (global positioning system) which can be accurate to within feet (or inches in some measurements). Other wells may be identified by latitude and longitude using a topographic map, in which case the accuracy may be within a few yards. Other wells are identified using the Public Land Survey, which gives locations in township, range, and section. Some older wells are identified using less scientific terminology, such as "just south of the orchard near the Johnson house", or something to that effect.

Once the wells are located, there is an issue with accuracy of the ground-water data. We typically base ground-water levels on elevation relative to sea level. However, field measurements are made as a depth below land surface and then converted to elevation. The problem lies in knowing the elevation of land surface at the well. GPS and other survey methods can give pretty accurate elevations, but the reality is that many wells are not surveyed and the elevations typically are determined using a topographic map. Therefore, the elevation or land surface determined for a well may be many feet off from reality.

Another issue concerning the accuracy of the ground-water data is how the water levels are collected. Most hydrologists and well drillers use either steel or electric tapes to measure the depth to water with accuracy in the tenths or hundredths of a foot. However, older data may have been collected with methods only accurate to the foot. In really deep wells, some tapes will stretch and give false readings. There is also human error based on the procedures used to collect the data (how careful and consistent the measurements were collected).

Once the data is collected, how it is stored is yet another issue. Some ground-water levels are stored in computer files in one format or another. Other data may be in written files or field books, and would need to be entered into a computer database to be used. Other data may be in even more obscure formats. For example, I remember seeing many years of ground-water data at a mining operation that was written in pencil on the walls of the shack that set over the well. This was a great long-term record, but it took some effort to put that into a useable format for a computer database.

So we see that just in the collection of ground-water data, there are many obstacles to putting together a single database. However, once this data is combined, the database will be an extremely useful tool for understanding the ground-water conditions over a long period of time in the study area.

In addition to ground-water levels, the database will have much more information. We plan to collect information from various sources on precipitation, evapotranspiration, vegetation cover, spring locations and measurements, surface water flow, water quality, geology, aquifer characteristics, and much more. The database will serve as a clearinghouse for a wide variety of data so that present and future studies can access any information related to ground water from a single location.

Not only will the database contain data, but it also will offer a bibliography of published information pertaining to the study area and either links or locations to access those publications. There have been numerical models developed for parts of the Carbonate Aquifer System in eastern Nevada and western Utah, and the database will identify, and potentially link to, as many of these models that can be identified.

One additional aspect of the database will be a map library consisting of Geographic Information System (GIS) coverages for the study area and adjacent areas in Nevada and

Utah. This GIS library will have maps and data from various sources that contain information such as topography, depth to water, geology, vegetation, land use, seasonal variations that relate to the water budget, and other useful coverages. This GIS library will be extremely useful not only to hydrologists on this study, but also to land managers, planners and a wide range of government and private groups with interests in eastern Nevada and western Utah.

It is clear that the collection of information and construction of a database for the BARCASS will be a significant part of the study, and the utility of this database to anyone interested in ground water in eastern Nevada and western Utah will be huge. This product will greatly contribute to the present and future studies of the ground water in the area.

If you have questions about the database or about BARCASS, please contact me through the Ely Times or at mstrobel@usgs.gov.